GRAZING IN THE FOREST RESERVES.

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INTRODUCTION.

In a consideration of the grazing problem in the forest reserves of the United States, it is necessary at every step to keep in mind the objects for which the reserves were set aside and the character, as well as the behavior, of the woods which exist on these several reserves. Since there appears to be still a great deal of confusion concerning the motives and objects which led to the formation of reserves, and also as to the character and behavior of forests in general, and the woods of the several reserves in particular, it may be helpful to review some of these points more in detail.

GENERAL DISCUSSION OF THE FUNCTIONS OF FORESTS.

When a farmer in Ohio or Indiana has a piece of woods on fairly level ground he has no good reason for keeping it as woods unless he considers the wood growing on the land to be as valuable as any other crop he might raise—a matter often difficult to decide. A farmer in Mississippi, on the other hand, may be induced to leave a patch of forest on a hillside, not because he cares much for the wood, but because, if the forest is cut away, the land will wash into a labyrinth of deep gullies and soon become utterly worthless for any purpose. In the former case the forest is merely for the crop it yields; in the latter it is for both crop and protection, and this case is far more common than is usually supposed. But while the farmer in Mississippi may use the forest to keep a piece of land from gullying, and thus use it as a protection against erosion, he cares little as to how this forest affects the flow of water or the climate, for he has ample rain and does not utilize the creek or stream. With the farmer in Gallatin Valley, Montana, this is quite different. He takes what seems to be a desert gravel bar and by the use of 1 inch of water per acre[1] he converts this arid ground into a farm and raises as high as 90 bushels of a superior quality of oats per acre. To him the little mountain stream is everything. Here the forest takes on another function; it holds the soil of the neighboring mountains and keeps it more pervious, and thus it regulates the flow in these important streams. The manner in which it does this will be clearer from the following: Suppose we take a table

[1] The inch of water here referred to is a miners' inch. Fifty miners' inches require a stream furnishing 1 cubic foot per second.

and tilt it several inches, so that its top represents a slanting surface. If we sprinkle water on this surface, it is clear that the water runs off about as fast as it strikes the table. If the table is now covered with a layer of soil about 3 inches thick, and the sprinkling is renewed, some of the water runs off from the surface and some soaks into the layer of soil, so that if, after a time, we quit sprinkling there will still be water running off from the table for hours. We have here then a "surface run-off" and an "underground run-off," and it is clear that the thicker the layer of earth, and the more pervious, the more water it would take up and the longer and steadier it would be giving off this underground water.

The above statement shows exactly what happens all over the land, and is especially noticeable in the mountains. On the soilless, rocky slopes the water runs off as fast as it falls or the snow melts, but on slopes with deep, pervious soils part of the water is stored and continues to flow for months after the rain or the melting of snow has ceased.

Returning to the experiment with the layer of earth on the table, we notice that if we sprinkle more briskly, part of the earth is carried away, the layer is eroded, and the storage ground is diminished. If covered by a layer of cotton batting this erosion stops, and in addition we gain another very important point—the soil is kept softer, and allows water to soak in more easily than when the cotton is wanting, for then the water "pats" down; it hardens the surface where it does not wash it away. Much the same result might be obtained by sowing grass on the layer of earth, for then the tops of the grass would keep the drops from pounding the earth, form a mechanical obstacle to the surface run-off, and the roots would be an additional help in holding the earth and keeping it from washing away. But the grass is small, its tops are short, open, and close to the ground; its roots are short; it rarely forms a dense sod, and, especially in dry countries, it leaves a large part of the ground without protection. Here, then, the larger, long-lived, deep-rooted trees, with dense, shading crowns high above the ground, give far better and more constant protection against erosion, and are far better able to keep the ground in a pervious condition, since they strew it annually with large quantities of leaves and twigs and provide a network of slowly decaying roots which keep the forest soil mellowed for a foot and more in depth. An upturned hemlock, spruce, etc., will readily illustrate how much of the ground is occupied by the roots of these forest trees.

The trees, then, are in nature what the cotton is in the experiment; they help to keep the soil from being carried away, they keep it soft, and they break the force of the downpouring rain.

How much additional service trees perform by keeping sun and wind from the ground is well illustrated by the forests of the Lake States and Canada, where thousands of swamps have dried up and hundreds

of miles of corduroy road have become useless, not by ditching and draining, but by removing the woods and giving sun and wind access to the soil.

In this connection, it may be well to mention a theory, sometimes advocated, which teaches that it would be better for water-storage purposes to have the forests removed in order that the snow may gather in large drifts, since, as it is claimed, it is these snowdrifts which supply the water of the streams throughout the dry summer season. This is not borne out by facts, for a study of the Big Horn Mountains and the Rockies of Wyoming, Montana, or Idaho will convince anyone that the few lingering snowdrifts of August have very little to do with the streams, and that it is the wooded and not the bald districts of each basin which serve as feeders and maintain the steady flow of water. The allied claim that snow melts more quickly in the forest than in the open is so palpably inconsistent with actual experience and simple physics that one might as well claim that the construction of an ice house to cover the season's supply was unnecessary, since ice would last longer in the sun than under cover.

Though there exist numerous forests in this country where the protective function of the woods is not apparent, in the majority of cases, and in all mountain districts without exception, the forest serves both to supply useful material and to protect and improve the ground, and thereby regulate the surface and underground drainage.

THE OBJECT OF THE RESERVES AND THE CHARACTER OF THEIR FORESTS.

For the forests of the present reserves it may be said that the protective function has been regarded as the more important. It is evident, therefore, that efforts will be made to maintain and improve these woods in order to continue to increase their usefulness in furnishing material, and still more in performing their protective function. This is the object of the forest reserves. The main purpose of the reserves is not exclusion, as is still so often claimed. They merely provide the means and men to give the much-needed care and protection which private enterprise at present could not afford and probably would be unwilling to furnish for a long time to come.

Scattered over a wide range of country, from the British line to Mexico, with climates varying from cold to hot, from excessively wet to arid, in altitudes of from 1,500 to 11,000 feet, the forests of the several reserves differ widely. In the Black Hills a fine forest of Yellow Pine covers a broad expanse of high, rolling ground and hills, and serves chiefly as a valuable source of timber. In the Western Rainier a dense forest of fine conifers on steep alpine ridges keeps the waters from carving the mountains into a waste. In the Big Horn a growth of pole-size Lodgepole Pine occupies a rough plateau, ranging

from 8,000 to 9,000 feet in altitude, and helps to keep the useful streams from going dry.

Similarly, these woods differ in their present condition. The valley of the Skagit in the Washington Reserve is almost an unbroken burn, and large burned-over areas, known as "burns," are scattered over the majority of the ridges of the east side of this same reserve. Similar conditions are met in the Mount Rainier, the Big Horn, the Priest River, and other reserves. In some cases these old burns have become reclothed with young forest trees, in others they are thickets of brush (species not trees), and in others they have changed to grassy pastures, often with little prospect of restocking under the conditions now prevailing. In some cases, as in the Big Horn Reserve, part of the extensive old burns are now so unmistakably prairie that it is difficult to prove that they were ever woods. Generally, however, a search reveals some fragments of stumps, bits of charcoal, etc., which show that at some time, at least, these places were not altogether prairie, and that a return to a wooded condition may be looked for. Besides these parks or grassy openings and small prairies (probably all due to fire), which in the aggregate cover many thousands of acres, there are large tracts of forest, such as the Yellow Pine woods of the Black Hills, where the mature timber, in keeping with the habits of this kind of pine, no longer forms dense stands. Here the ground is but little shaded, and a vigorous growth of grass and weeds eagerly seizes upon every yard of available soil, and thereby often prevents the starting of tree growth. (Pl. XXXII.)

In other districts, where high altitudes tend to give an alpine character to the land, tree growth naturally becomes more scrubby and broken, and, in regions like the Cascades, at the tops of the high ridges are grassy parks, covering many thousands of acres more or less interrupted by patches of scrub woods. Whether these grassy areas were ever entirely clothed with woods, and whether, with any reasonable amount of care or protection, they can be made to reclothe themselves, is still in some cases uncertain.

In general, then, the forests of the reserves are primarily protective forests, they differ from reserve to reserve, they are all more or less damaged by fires, and in all dry localities and at high altitudes they are interrupted by grassy areas, the majority of which have long been in their present condition, and will probably require a long period of time before they are restocked with woods. (Pls. XXXIII and XXXIV.)

REGULATIONS FOR GRAZING IN THE RESERVES.

When the several reserves now in existence were created, the majority of them included districts which had been used for some time for grazing purposes, and the attempt to stop further grazing affected interests of considerable magnitude.

FIG. 1.—AN OLD BURN AS SHEEP RANGE. MOUNT RAINIER RESERVE.

FIG. 2.—SHEEP IN OPEN-PARK WOODS OF YELLOW PINE. BLACK MESA RESERVE.

FIG. 1.—OLD BURN WITH DENSE GROWTH OF YOUNG PINE ("TOO MUCH BRUSH"), NOT USED AS RANGE. WASHINGTON RESERVE.

FIG. 2.—OLD BURN IN THE ALPINE REGION OF THE CASCADES (LITTLE REPRODUCTION AND POOR FEED). WASHINGTON RESERVE.

PRESENT RULES FOR GRAZING IN THE RESERVES.

At present, the following ruling of the General Land Office, based on the law approved June 4, 1897, and published in a circular, "Rules and regulations governing forest reserves," November 6, 1900, govern in all affairs of grazing within the reserves:

PASTURING OF LIVE STOCK.—The pasturing of sheep and goats on the public lands in the forest reservations is prohibited: *Provided*, That in the States of Oregon and Washington, where the continuous moisture and abundant rainfall of the Cascade and Pacific Coast ranges make rapid renewal of herbage and undergrowth possible, the Commissioner of the General Land Office may, with the approval of the Secretary of the Interior, allow the limited grazing of sheep within the reserves, or parts of reserves, within said States. *And also provided*, That when it shall appear that the limited pasturage of sheep and goats in a reserve, or part of a reserve, in any State or Territory will not work an injury to the reserve, that the protection and improvement of the forests for the purpose of insuring a permanent supply of timber and the conditions favorable to a continuous waterflow, and the water supply of the people will not be adversely affected by the presence of sheep and goats within the reserve, the Commissioner of the General Land Office may, with the approval of the Secretary of the Interior, also allow the limited grazing of sheep and goats within such reserve. Permission to graze sheep and goats within the reserves will be refused in all cases where such grazing is detrimental to the reserves or to the interests dependent thereon, and upon the Bull Run Forest Reserve in Oregon, and upon and in the vicinity of Crater Lake and Mount Hood, or other well-known places of public resort or reservoir supply. The pasturing of live stock, other than sheep and goats, will not be prohibited in the forest reserves so long as it appears that injury is not being done the forest growth and water supply, and the rights of others are not thereby jeopardized. Owners of all live stock will be required to make application to the Commissioner of the General Land Office for permits to graze their animals within the reserves. Permits will only be granted on the express condition and agreement on the part of the applicants that they will agree to fully comply with all and singular the requirements of any law of Congress now or hereafter enacted relating to the grazing of live stock in forest reserves, and with all and singular the requirements of any rules and regulations now or hereafter adopted in pursuance of any such law of Congress; and upon failure to comply therewith, the permits granted them will be revoked and the animals removed from the reserves. Permits will also be revoked for a violation of any of the terms thereof, or of the terms of the applications on which based.

PRINCIPLES FOR FUTURE REGULATIONS FOR GRAZING IN THE RESERVES.

In the future, the following principles, lately announced by the Secretary of the Interior, will be the basis of all grazing regulations in the reserves. The central idea is cooperation between the Government and the grazing interests in securing the best management and bringing about the best condition of the range.

(1) The Government, through its forest officers, after consultation with the representatives of the various interests involved, should decide on the number of head to be grazed in each forest reserve, or each subdivison of a reserve, and should establish the boundaries between cattle range and sheep range.

(2) The local association should assign ranges to owners within the limits thus laid down, subject to official approval.

(3) Both owners and local associations should be held responsible for the observance of the terms of permits and the prevention of fire and overgrazing.

(4) Each sheep owner should have the exclusive right to his range, and the same should apply within reasonable limits to groups of cattle owners.

(5) Permits should run for five years.

(6) Residents should have precedence in all cases over tramp owners and owners from other States.

(7) Local questions should be decided on local grounds and on their own merits in each separate case.

(8) Since the forest reserves are usually summer ranges, provision should be made for necessary routes of transit.

(9) The policy of the Government should be based on regulation rather than prohibition, except in special cases, it being understood that the avoidance of overgrazing is equally in the interests of all parties.

Grazing of sheep is permitted in parts of eight of the reserves. Cattle are allowed in all. Anyone wishing to use the reserve pastures must obtain a permit. These permits are granted free of charge; the number of animals is limited, and the time of entrance into and exit from the reserve, as well as the district where they are to graze, is decided by the Department of the Interior.

In carrying out these principles the rules now adopted are: Wherever an association of sheep men exists, which represents the majority of those who have for at least two years used the reserve pastures, such an association is recognized. Blank applications are sent to the secretary of the association, and he distributes them and gets them filled and signed. He then transmits them to the supervisor, and the latter to the Department, when permit is issued. To set forth more definitely the requirements of the Department and the conditions of such a permit, the following appears printed on every application and permit:

This application is also made with the understanding, and full agreement thereto, that penalties will be imposed for a violation of rules as follows:

PERMITS CANCELED AND REFUSED.

1. For obtaining or attempting to obtain a permit on false representations.
2. For willful trespass upon areas where not permitted, either on closed areas or the ranges of others.
3. For setting out fires to clear range.
4. For *willful* negligence in leaving camp or other fires.
5. For refusing to observe promptly any direct order from the Department requiring an observance of any rule.

OTHER PENALTIES.

The number of sheep covered by a permit to be materially reduced for the following stated causes, viz:

1. For crowding onto a neighbor's range without the consent of said neighbor.
2. For bedding sheep more than six nights in succession in any one place, except when bedding bands of ewes during lambing season.
3. For entering the reserve prior to the date authorized.
4. For remaining in the reserve after the permit has expired.
5. For corralling within five hundred yards of a running stream or living spring.

FIG. 1.—ALPINE PARK WOODS NEAR COWLITZ PASS, ON THE CREST OF THE CASCADES. MOUNT RAINIER RESERVE.

FIG. 2.—A SITUATION WHERE THE GROUND NEEDS ALL THE COVER IT HAS. BLACK MESA RESERVE.

FIG. 1.—COMMON SHEEP RANGE. BLACK MESA RESERVE.

FIG. 2.—SHEEP RANGE ABOUT MOUNT ADAMS. MOUNT RAINIER RESERVE.

6. For gross carelessness in leaving camp fires.

7. For failure to aid in extinguishing a fire occurring within the range occupied when possible to do so.

8. And for such other minor violations of the rules as may occur.

9. For failure to remove sheep promptly upon order of forest officer when damage is being done to the range.

10. For failure of herder to corral for count, upon order of forest officer or ranger, when number of sheep appears to be greater than the number covered by permit.

I also agree to forfeit the permit for a violation of any of its terms or of the terms hereof or whenever an injury is being done the reserve by reason of the presence of the animals therein.

(Signed) ——— ———.

EXTENT OF GRAZING IN THE RESERVES.

The following tables show the extent of grazing in the reserves:

Sheep grazing in the reserves in 1901.

Reserve.	Area in reserve.	Number of sheep allowed in reserve.	Grazing season allowed for calendar year 1901.	Number of permits issued.	Number of sheep covered by permits issued.
	Acres.				
Black Mesa, Arizona	1,658,880	225,000	April 1 to December 1	57	176,485
San Francisco Mountains, Arizona.	975,360	125,000	.....do	[a]20	90,700
Gila River, New Mexico	2,327,040	225,000	January 1 to August 31	30	134,320
Uinta, Utah	875,520	200,000	July 1 to October 1	87	188,050
Cascade Range, Oregon	4,588,800	200,000	June 15 to October 15	44	166,050
Big Horn, Wyoming	1,147,840	150,000	June 1 to September 20	[b]54	150,000
Mount Rainier, Washington	2,027,520	250,000	July 1 to September 25	89	249,713
Washington, Washington	3,426,400	25,000	.....do	[c]6	25,000
Total	.....	1,400,000	.....	387	1,180,318

[a] Five additional applications covering the remainder of the sheep allowed are pending.

[b] Thirty-four additional applications covering 99,400 sheep were rejected.

[c] Sheep allowed only in Okanogan County.

Cattle and horse grazing in the reserves in 1901.

Reserve.	Area in reserve.	Stock allowed to enter the reserve.			Permits issued.	Stock covered by permits issued.		
		Cattle.	Horses.	Cattle and horses combined.		Cattle.	Horses.	Cattle and horses combined.
	Acres.							
Black Mesa, Arizona	1,658,880	25,000	5,000	30,000	97	15,618	2,259	17,877
Prescott, Arizona	423,680	2,500	1,000	3,500	9	77	15	92
Grand Canyon	1,851,520	10,000	2,500	12,500	15	505	516	1,021
San Francisco Mountains, Arizona	975,360	20,000	5,000	25,000	110	11,311	3,364	14,675
Gila River, New Mexico	2,327,040	55,000	10,000	65,000	183	41,061	4,618	45,679
Pecos River, New Mexico	431,040	10,000	2,500	12,500	147	3,757	845	4,602
Lake Tahoe, California	136,335	.....	.....	[a]2,500	13	1,780	205	1,985
Stanislaus, California	691,200	.....	.....	[a]8,000	39	6,603	692	7,295
Sierra, California	4,096,000	.....	.....	[a]30,000	180	24,775	1,090	25,865

[a] Each horse to count as two head of cattle.

Cattle and horse grazing in the reserves in 1901—Continued.

Reserve.	Area in reserve.	Stock allowed to enter the reserve.			Permits issued.	Stock covered by permits issued.		
		Cattle.	Horses.	Cattle and horses combined.		Cattle.	Horses.	Cattle and horses combined.
	Acres.							
Pine Mountain and Zaka Lake, California	1,644,594	.....	.....	(a)	20	893	40	933
Santa Ynez, California	145,000	.....	.....	(a)	12	38	48	86
San Bernardino, California	737,280	.....	.....	(a)	18	3,095	40	3,045
San Gabriel, California	555,520	.....	.....	(a)	25	266	131	397
San Jacinto, California	737,280	.....	.....	(a)	16	1,080	.....	1,080
Trabuco Canyon, California	109,920	.....	.....	(a)	4	210	.....	210
Battlement Mesa, Colorado	858,240	.....	.....	47,000	149	43,065	3,931	46,996
Pikes Peak, Colorado	184,320	.....	.....	4,800	16	1,374	46	1,420
Plum Creek, Colorado	179,200	.....	.....	7,500	43	3,686	229	3,915
South Platte, Colorado	683,520	.....	.....	26,000	82	13,447	361	13,808
White River, Colorado	1,198,080	.....	.....	61,000	154	40,335	1,968	42,303
Fish Lake, Utah	67,840	.....	.....	2,100	5	370	4	374
Uinta, Utah	875,520	.....	.....	10,500	60	4,313	7	4,320
Bitter Root, Montana	691,200	4,000	2,000	6,000	1	400	0	400
Flathead, Montana	1,382,400	5,000	2,000	7,000	39	64	181	245
Gallatin, Montana	40,320	3,000	1,000	4,000	3	125	20	145
Lewis and Clark, Montana	2,926,080	20,000	7,000	27,000	52	5,968	775	6,743
Cascade Range, Oregon	4,588,800	3,800	550	4,350	12	1,535	10	1,545
Black Hills, South Dakota and Wyoming	1,211,680	.....	.....	7,000	166	5,720	1,276	6,996
Big Horn, Wyoming	1,147,840	.....	.....	15,000	123	13,805	1,179	14,984
Teton, Wyoming	829,440	.....	.....	2,000	32	1,742	212	1,954
Mount Rainier, Washington	2,027,520	.....	.....	6,000	94	5,689	240	5,929
Olympic, Washington	2,188,800	750	250	1,000	2	129	.....	129
Washington, Washington	3,426,400	.....	.....	7,500	0	0	.....	0
Total	.....	.....	.....	434,750	1,921	252,746	24,302	277,048

[a] Only the stock of settlers living within and immediately adjacent to the reserves allowed therein.

METHODS OF "RUNNING" STOCK AND THE EFFECTS ON RANGE AND WOODS.

Being mostly high mountain country, the reserve pastures can not be used throughout the year, but serve as summer range. The animals are wintered outside of the mountains, on a regular "winter range," usually extensive, dry prairie country where the snowfall is not sufficient to prevent grazing. Some of these winter ranges are practically desert regions through the summer, lacking both feed and water. Others furnish enough of forage, but the feed is dry and there is no drinking water on large portions of the districts, so that grazing on such ranges is poor and is limited to the vicinity of water holes or streams. (See Pl. XXXV.)

Generally, these prairie ranges are less suited as summer pasture to sheep than to cattle, since the latter stand the dry feed and intense summer heat better than do the sheep.

In the spring of the year the live stock is driven to the mountains and held there until the fall or winter storms drive them back to the winter range. In this way the reserve and other mountain pastures serve a rather peculiar function, and the indirect value of these mountain pastures is often greater than the direct value. They not only furnish pasture for a certain number of head of stock for a certain period, but by serving as summer range they make it possible to use large, arid regions for winter range, and thus greatly extend the grazing industry. For instance, the mountains included in the Mount Rainier Reserve have for years furnished summer range for about 250,000 head of sheep and several thousand head of cattle. Since the summer range outside of the reserve is mostly occupied and since the winter range is too dry to be used during summer, it may be said that the reserve pastures are essential to the maintenance of the bands in this section of Washington. It follows that closing these pastures would lead either to a reduction of the bands by about the number enjoying summer range, or to a radical change in the way of running sheep, and since these sheep represent a gross income of about $2 to $2.50 per head a year, such a reduction would materially affect the income of these communities until offset by the change just mentioned. With owners of cattle, usually farmers, near the boundaries of reserves the same conditions prevail. In the case of farmers and stockmen living within the reserves, the pastures of the reserves are, of course, their only available range, and, in many cases, are of more value to the farmers than the farms themselves.

Since the handling of sheep and cattle differs in many important points, the two cases are best considered separately, and since sheep grazing in the reserves is at present the more important of the two, it will be considered first.

SHEEP GRAZING.

TIME OF ENTERING THE RANGE.—The sheep of the Western mountain regions (generally "grade" Merinos and coarse-wools mixed) are owned for the most part by residents of the counties in which the reserves lie. They are run in flocks or "bands" of 2,000 to 3,000 head, in charge of a herder who is assisted by a "camp tender," "packer," or "camp rustler," whose business it is to look up range, move camp, and "pack" in supplies, including salt for the sheep.

The time of entering the reserves naturally varies with the climate of the particular district. In the northern reserves the herds are lambed and sheared before they begin their journey to the mountains, but in the southern reserves, as, for instance, the Black Mesa of Arizona, the shearing commonly precedes the lambing, the latter taking place in the reserve, and in some cases the sheep are sheared and lambed in the reserve.

Accordingly, the sheep enter the Black Mesa as early as April, while those of Mount Rainier do not reach the reserve line before the

middle of June or the beginning of July. Similarly, the sheep of the Black Mesa remain in the reserve until November; those of the Rainier, Big Horn, etc., are driven out by the fall storms as early as from the middle to the end of September.

Of late years a definite time of entering and leaving the reserve has been prescribed for each reserve, according to location and other conditions, much to the improvement of the range and also to the general satisfaction of the better sheep men.

JOURNEY TO THE MOUNTAINS.—In their journey to the mountains the sheep are usually obliged to follow certain natural highways, and their progress and the work of handling them is largely governed by the surroundings. Wherever possible, the sheep are allowed to travel slowly and graze as they go. Where these bands are obliged to move right along, as, for instance, in rocky defiles, patches of timber, etc., where no feed exists, the band is held close, the sheep are obliged to crowd closely together, and in consequence the trail takes on somewhat the appearance of a wide, much-traveled road. The small vegetation is destroyed, the ground is worn into numerous rut-like trails, and the bushes and small trees along these trails are rubbed and nibbled, and in some cases more or less barked and killed. Since these trails are commonly 50 to 100 yards in width, they are very conspicuous, and since they usually serve for ordinary travel as well as for the sheep, they are seen by many, and often, no doubt, the condition of the range, on the whole, is judged by these unsightly trails.

Where many bands travel the same trail and occupy the same summer range there is considerable rivalry, and in crowded districts the journey into the mountains often becomes a regular race for the better camps, much to the detriment of the sheep and range. Before the time of entrance was definitely regulated, men would start early and follow closely upon the receding snow. The freshly shorn sheep were exposed to the severities of storms, and were exhausted by rapid traveling. The range suffered even more—the ground was still wet, the feet of the animals sank deeply, and the sod was cut and damaged. In addition, the grass had just started; it was still too short to make good grazing, and thus the sheep were induced to run, and required extra moving. In this way considerable areas in nearly all reserves were completely ruined. The result is that the mat of vegetation has disappeared and the ground is bare.

A proper reduction of the number, the regulation of the time of entrance, and the division of the range have done much to prevent these injuries, and in some places a reclothing of such areas has been observed.

OCCUPATION OF THE RANGE.—The manner of occupation of the summer range differs in different reserves. Thus, in the Big Horn the several bands go wherever there is room and feed, the same band

FIG. 1.—PINE NIBBLED BY SHEEP. BIG HORN RESERVE.

FIG. 2.—PINE NIBBLED BY SHEEP. BLACK MESA RESERVE.

FIG. 1.—SHEEP IN THE OPEN-PARK WOODS OF YELLOW PINE (PINE SEEDLINGS SURE TO SUFFER). BLACK MESA RESERVE.

FIG. 2.—CONDITIONS UNDER WHICH THE SEEDLINGS SUFFER. BLACK MESA RESERVE.

occupying any part in the opened portion of the reserve. In the Rainier the range is divided into sheep and cattle ranges, the sheep range being divided into five well-defined districts, and each band of sheep receives a permit for only one of these districts. This measure has proven of great value by reducing the needless roaming of the numerous bands. In a few localities this division is carried a step further, and each man claims a certain territory or range by right of priority, in some cases reinforced by the fact that the stockman owns some lands within the range, including usually the best watering places, with some buildings and other improvements.

Generally, the law of priority prevents one herder from crowding in on the range of another, but when the entire range is crowded and feed is short, as in dry seasons, necessity sets aside all established rules.

THE MANNER OF GRAZING.—The grazing itself is quite similar everywhere. In the morning the band leaves camp, spreads out when it reaches good feed, grazes for some hours, rests during the warmer part of the day, resumes grazing, and toward evening returns to camp, where it is "bedded" on a piece of well-drained ground, preferably an open hillside.

Where a camp is used for a considerable time, especially in the case of large bands, this daily return to the same bedding ground is one of the most objectionable features of sheep grazing in the mountains. On the bedding ground itself everything is destroyed, and the ground is covered with a deep layer of manure which, if the sheep are bedded near a stream, washes down into the stream during heavy rains, and thereby pollutes the water.

In a fresh camp the sheep spread out at once in the morning and feed away from camp. But after some nights of bedding in the same spot, the ground about the camp ceases to have palatable feed, and the sheep merely travel over it, usually in a dense body, with from 10 to 50, traveling in the characteristic single file. This soon cuts the ground and grass along definite lines, and in a couple of weeks there are dozens of rut-like trails leading in all directions from the camp. This naturally grows worse, and each day sees more of this cutting of trail than the preceding, since the distance becomes greater and greater. That this evil is worse with larger bands than with smaller ones, and that it is worse on the poorer and closer-cropped ranges and during unfavorable seasons, is self-evident.

If the camp is located near or in timber, this frequent, forced return to the same bedding ground leads the sheep to mutilate young trees by nibbling and rubbing, even though they do not care for any part of the trees as forage. But what is even worse, the frequent march over the same ground by densely massed bodies of sheep necessarily destroys much young growth, particularly in the seedling stage. (Pls. XXXVI and XXXVII.)

In addition to the injury to range and woods, this persistent trailing back and forth to camps naturally affects, or rather disturbs, the surface conditions of the ground. Keeping in mind our illustration of the layer of earth on the table, it is clear that the cutting short of the grass cover, or the forest floor, has some influence on the run-off of water, and that this influence invariably is to increase the rate of run-off, and thereby the power of the water to carry away the soil. That the many thousands of little trails, cut as they are in parallel lines along the hillsides of every valley, naturally act as so many ditches, facilitate greatly the run-off, and establish definite lines of erosion, is equally clear.

HERDING.—In herding through the day, the sheep rarely go much more than one mile from camp, generally less. The herding itself depends mostly on the herder, but also on the character of sheep and range. Some men keep the sheep close together, and move them along while feeding; others allow them to spread as they please, and merely watch them to avoid loss from straying off and from wolves, etc. Where the sheep are held close, the strongest ones usually form the front and sides of the band, and get the pick of the feed, while the poorer ones in the center and rear must content themselves with the leavings. This naturally leads to restlessness, and involves much useless travel, which is still increased by the frequent use of the dog. At every turn the dog is sent to drive back, and every time he does so the feeding of part of the band is interrupted, and there is more or less crowding and running, which in every case means trampling and destroying of feed instead of using it. It should not be inferred that this close herding is always a mere matter of disposition or due to lack of experience, for such is not the case. During and just after lambing, in territory with many wolves, on old burns with much down timber, on very rough and rocky ground, in "brushy" country, in some cases during storms, and in fact wherever it is impossible to see the sheep a long distance, and where there is danger of straying off, close herding is necessary, and a certain amount of this must, therefore, always be expected.

FOOD PREFERRED.—The feed in these mountains is usually divided into three classes—grass, "weeds" (herbaceous vegetation other than grass), and "browse" (leaves and twigs of shrubs and trees). Most camps or ranges contain all three. Regular browse camps are the exception, and an all-grass range is rarely satisfactory sheep ground. In feeding, the sheep loves variety, prefers the short green feed, takes nearly everything, and thus cuts clean and close. On nearly all ranges this close cropping, together with the trampling, kills out some of the less resistant grasses and other plants and leaves the ground to the more resistant. A common and well-known example of this is seen where the mountain bunch-grass is killed out, frequently leaving the ground more or less bare for some time, when the more resistant grasses restore the cover.

Generally, the sheep do not eat any of the conifers or real forest trees of these mountains. They nibble them and injure them by crowding and nibbling about bedding grounds and along trails, and they feed on young trees and boughs of conifers in cases of dire necessity, but by far the greatest injury to tree growth undoubtedly consists in the trampling of seedling trees.

SOME RESULTS OF GRAZING ON THE RANGES.—In all cases of grazing the range is cut close, and this close shaving of the vegetable cover, together with the loosening of the soil, especially on all hillsides, naturally results in an appreciable change of the surface conditions and consequent surface run-off.

That lazy herding, where a camp is fairly "worn" out, and that all overstocking, and consequent overgrazing, increase the several kinds of injury here pointed out, goes without saying.

But while it is thus quite evident, therefore, that sheep grazing can never be conducted without more or less injuries, it is unfair to suppose, as has been too often the case, that grazing always results in serious mischief, and should, therefore, be forbidden.

To be sure, the bedding ground and trail are unsightly wastes, but they form a very small percentage of the entire area and in many cases occupy rough, rocky waste ground, of little importance for any purpose. In addition, it must be stated that the best sheep men have given up the old method of bedding for long periods in the same place and are adopting the proper way, bedding only one or at least only a few nights in a place; also, that most of the ordinary bedding grounds rapidly recover and, when once reclothed with grass, far excel the surrounding ground, so that many of these old bedding grounds are conspicuous by the luxuriance of their vegetation.

Similarly, the damage to the forest growth, even along the trails and about bedding grounds, has so far proven a serious permanent mischief only in a few special localities, such as parts of California and Arizona, where unfavorable peculiarities of climate and soil combine to resist the reproduction of the forest, and therefore need but little assistance, supplied by the sharp foot of the grazing animal, to prevent young growth altogether. In other localities, such as the Big Horn, the Rockies of Montana, and the Cascades of Washington, one meets some of the finest cases of natural reproduction of pine in the immediate vicinity of trails and bedding grounds. Such cases demand consideration, and seem to throw much doubt on the sweeping statements commonly made.

In the same way the matter of aggravated erosion due to grazing seems often overdrawn. As above indicated, there is no grazing without disturbance of the surface conditions, and there are numerous instances on record where overgrazed areas (overgrazed by cattle as well as by sheep) have begun to "gully," and otherwise show serious signs of mischief from erosion. Even in the many districts where a

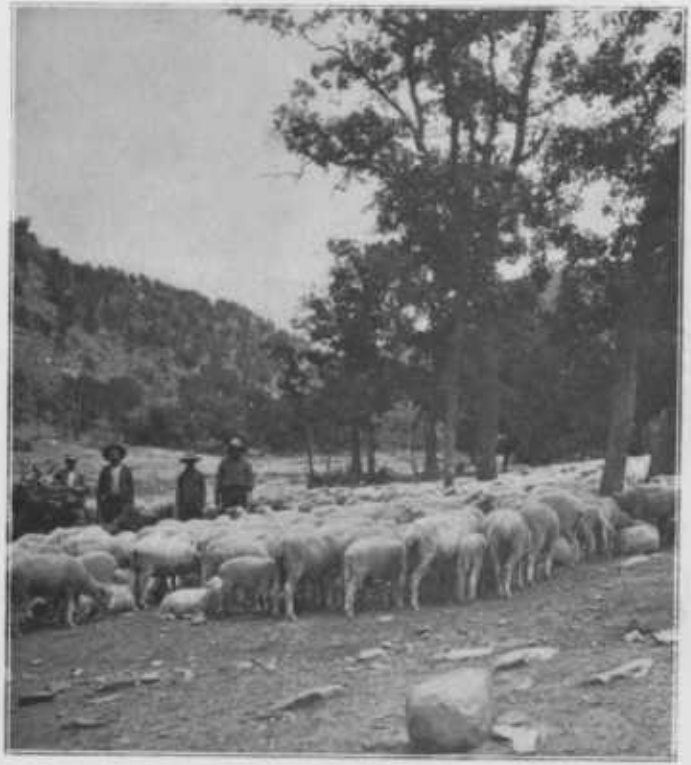
more resistant soil has so far held firm, and the general appearance is such as to mislead most men into the belief that no disturbance exists, a closer scrutiny usually proves that all badly treated, overgrazed areas have suffered injury, and that a more general injury may be looked for in time. Nevertheless, it must be conceded that in several of the reserves the disturbance due to this cause is thus far insignificant, and that it is reasonable, therefore, to suppose that with proper limitations grazing may be carried on without great damage.

In judging the mischief done by sheep to the range itself, it is a common error to mistake a short-cropped range for a poor or injured range. Some of the older ranges, like the Red Desert of Wyoming, were on this account supposed to be "all killed out" more than fifteen years ago, and yet these very same ranges support as many sheep as ever, and support them fully as well. Similarly, parts of the Cascades have been used, and used hard, for many years, but in spite of being closely cut, and in spite of the fact that the tall bunch grass has long disappeared, the bands do as well as ever. This fact is so well known that it has misled many of the stockmen into the belief that since it is true with them it must be true everywhere. Such, however, is not the case. In some of the California and Arizona districts the mountain range, like that of parts of the lowland prairies, has been destroyed by overstocking, and there is good reason to believe that unlimited grazing, like unlimited lumbering, will result everywhere in general destruction of range as of forest. (Pl. XXXVIII.)

FIRING THE WOODS OF THE RANGE.—A mischief far more serious than any above mentioned, namely, that of setting fire to the woods, is often charged to the sheep industry, as though it were one of the natural consequences of this business. How far these charges are based upon prejudice against the sheep industry is difficult to say. To charge the sheep men with the many burns seems hardly fair, since the ungrazed portions of the same reserve often present as many and as extensive burns as do the regular ranges. Similarly, it seems to be now quite generally conceded that little, if any, benefit is derived from setting fire to the range, a practice quite common in the pineries of the South and elsewhere. Frequently it was argued that because many of the reserve pastures are located in burns it was fair to assume that these reserve pastures might be, and probably were, improved and extended by fires.

As matters stand, it would appear from observation and evidence that none of the reserve ranges are materially benefited by firing. Being mountain pastures, the feed is green; and being closely cropped, there is no need of removing tall dead grass, as is the case where firing is practiced. In dense, standing timber and windfalls fires usually produce sufficient heat to destroy all vegetation, and in addition leave the ground in such a condition that there is little or no feed for years. To set fire in such a place the herder endangers his camp outfit and

Yearbook U. S. Dept. of Agriculture, 1901.



IN THE GILA RESERVE, WHERE GRAZING NEEDS REGULATION.

Yearbook U. S. Dept. of Agriculture, 1901.

FIG. 1.—TALL GRASS, WHERE FIRE IS APT TO SPREAD. BLACK MESA RESERVE.

FIG. 2.—SHEEP RANGE IN TALL WOODS.

sheep, loses a large amount of valuable feed, and can not hope to gain any material benefit for a number of years, by which time he will in all likelihood have abandoned the particular range.

While carelessness in the management of camp fires, etc., is possible with sheep herders, as with other persons, it must be granted that their experience, together with their material interests, would naturally check and correct such deficiencies. In addition, it seems proper to state that the experience with fires in the Big Horn Reserve during the summer of 1900 clearly proves that with a cordial cooperation of sheep men and rangers, the former furnish a very desirable body to draw from in case of emergencies. Where it requires from two to four days to fetch men from beyond the limits of the reserve, such assistance from the sheep men may be of the greatest importance.

In denying the charges of firing the woods, the sheep men correctly point out that the closely fed park lands are less liable to be fired, and that in many cases fires have actually come to an end when reaching closely cropped sheep ranges. (Pl. XXXIX.)

CATTLE GRAZING.

As stated above, the grazing of cattle is not forbidden. The cattle are owned mainly by farmers and small stockmen living near or in the reserve. Generally, and very properly so, a definite range is set aside for cattle, from which sheep are entirely excluded. Usually a number of cattle owners join in bringing their cattle into and out of the mountains.

Like sheep men, the owners of cattle make application to the supervisor for the privilege of grazing their stock in the reserve. To residents within the reserve whose herds do not exceed 100 head the supervisor may grant the grazing privilege himself; all other applications he merely transmits to the Department of the Interior with his recommendations, and the permit is issued by the Secretary. As in the case of sheep men, preference is given to the different cattlemen in the following order: (*a*) Residents within the reserve; (*b*) persons owning farms or lands within the reserve; (*c*) persons living near the reserve; (*d*) persons living distant from the reserve.

Persons not residing in the State where the reserve is located and persons not citizens of the United States are debarred entirely.

On the whole, the cattle brought from the plains dislike the mountains, and in many cases require to be kept there, either by fences erected across the valleys or by herders, whose duty it is to drive them back, keep them scattered, and salt them. By far the greater part of the cattle in the reserves are not herded; they are merely turned loose in the mountain parks and prairies, salted at regular intervals, and otherwise left without care or protection.

The cattle prefer the open parks, usually along the creeks; they dislike the denser woods, rough and steep ground, and high elevations.

They feed chiefly on grass and refuse weeds, and take little browse (except in some of the southern reserves). Cattle feed less closely than sheep, and being free, each animal travels only when it wants to, mostly to and from water. They use much less of the entire area of the reserve, and take only a portion, often the smaller portion, of the feed.

That cattle do no damage at all, as is so often claimed, is not true. Cattle cut trails on all hillsides, particularly in the vicinity of water. They are filthy about watering places, standing often for hours in and about the water and trampling many springs into unsightly mires; occasionally they browse; they bark trees by rubbing, and they naturally trample seedling trees, just as any other animal would. Being loose footed, there should be less trampling; but this is not always the case, since cattle by their very laziness are apt to stay more persistently on any given small area. That cattle do less harm to the range is only partly true. They crop it less closely, but choosing only grass and leaving the weeds, many a cattle range has been changed into a "weed patch." That overgrazing and consequent increase of all injuries is possible with cattle as with sheep is self-evident, and has been fully established on a number of ranges.

Numerous suggestions have been made for the restriction of grazing in the forest reserves. The most urgent and weighty of petitions of this kind come from the farmers in the vicinity of the reserves, who see in these mountain forests the protection for their all-important water supply. These petitions are fully considered each year in the allotments, and whenever the presence of sheep or cattle in these mountains appears to seriously endanger important agricultural interests it is but natural that the principle of the greatest good to the greatest number should prevail.

For a better regulation of the grazing, it has been suggested that, at least for sheep, and preferably also for cattle, the ranges be subdivided as far as the mountainous character of the reserves permits, and that each stock owner be allotted a well-defined range. This, as was correctly pointed out several years ago by Mr. Frederick V. Coville, Botanist of the Department of Agriculture, in his bulletin on the grazing in the Cascade Reserve of Oregon, would induce the stockman to care for his range, to protect it against fire, and to improve it by seeding or otherwise, and would prevent heedless overgrazing.

To carry out such a system would entail considerable additional expense upon the Government, and it has therefore been suggested that a per capita tax or rental should be imposed on all stock grazing in the reserves.

Though there is still considerable opposition to such a system, it may be said that nearly all of this opposition to-day does not come from the resident, permanent stockmen, but comes mostly from men who run stock wherever there is open range, avoiding all responsibility and owning little outside of their herds.